ICAROHS - Inter-Comparison of Aerosol Retrievals and Observational Requirements for Multi-wavelength HSRL Systems

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Active remote sensing methods like space-borne lidars are promising approaches towards the global mapping of aerosol radiative properties. At present CALIPSO as part of NASA's A-TRAIN is the only spaceborne lidar available. The strategy being employed to quantify climate forcing by anthropogenic aerosols using the CALIPSO lidar (CALIOP) together with other A-train measurements is described by Anderson et al. (2005). The CALIOP instrument is designed as a backscatter lidar, which requires *a-priori* assumptions on the ratio of extinction to backscatter (lidar ratio) and thus on the aerosol/cloud type for the data analysis. The only current methods for separating aerosol signals from molecular backscatter signals are the High Spectral Resolution Lidar HSRL (Esselborn, et al., 2007) and Raman lidars. ESA's cloud and aerosol mission EarthCARE plans for a spaceborne HSRL system.

The STSE study ICAROHS exploits the potential improvements and benefits of novel multi-wavelength HSRL technology combined with innovative retrieval methods (Müller, et al., 2010) for future satellite missions. Current single-wavelength High Spectral Resolution Lidar (HSRL) data combined with in-situ data from several field studies serve as data base for the development of improved scientific algorithms for retrievals of aerosol optical properties.

The data base covers the relevant aerosol types continental aerosol (LACE 1998), fresh and aged mineral dust (SAMUM), smoke (SAMUM), and continental and marine aerosol (EUCAARI). This data base of actual lidar measurements is being used to construct simulated atmosphere "scenes" using the EarthCARE simulator ECSIM (Voors, et al., 2007). Figure 1 shows a first test case comparing HSRL data and ECSIM simulations with respect to the HSRL Mie signal (left) and the corresponding extinction profile (right).

The study approach tackles the identification of various aerosol types from active remote sensing data; see Figure 2 for an example from single-wavelength HSRL data. This aerosol classification is then used for the global mapping of key parameters governing the direct climate forcing of aerosol particles. First results on aerosol classification, satellite scene simulation and retrieval of aerosol properties will be discussed.

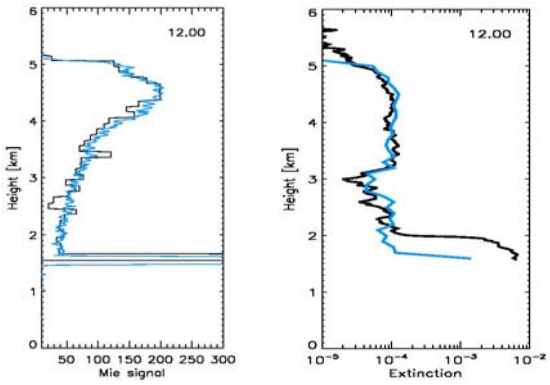

Figure 1: Vertical profiles of the HSRL Mie signals (left) and the corresponding extinction profiles (right) for a well mixed mineral dust layer over Ouarzazate, Morocco; blue: HSRL data, black: extracted from the corresponding ECSIM scene.

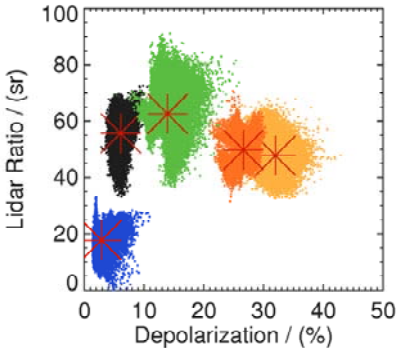

Figure 2: Aerosol classification from HSRL data; blue: marine; black: anthropogenic; green: biomass burning; orange: biomass burning smoke mixed with dust; yellow: dust; red lines: 1-σ interval.

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